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THE PEALE'S PEREGRINE FALCON IN BRITISH COLUMBIA: STATUS AND MANAGEMENT

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The Peregrine Falcon (Falco peregrinus), already a bird of historical and cultural significance, became the focus of world-wide attention after its population began to dramatically decrease in the late 1950s. Many scientific and naturalist studies followed. The results of those studies, together with the findings of several British Columbia Wildlife Branch surveys, can be applied to Peregrine Falcons in British Columbia and provide a sound basis for the management of the Peregrine Falcon population on the Queen Charlotte Islands. This paper presents that information and framework.

DESCRIPTION

Peregrine Falcons vary in size, but their average size is similar to that of a crow. The female measures 45 cm to 55 cm in length and weighs from 800 to 1600 grams. The male, approximately two-thirds the size of a female, is 38 cm to 45 cm in length and weighs 500 to 1050 grams (Beebe 1974; White 1982; Godfrey 1986). Adults of both sexes have a dark crown, upper neck and moustache mark, slate-coloured back and wings, barred tail and light underparts with dark barring. Immature birds, to age one year, are brownish and have streaked rather than barred underparts (Beebe 1974; Godfrey 1986).

DISTRIBUTION AND NUMBERS

Of about 20 subspecies world-wide, only three occur in North America (Brown and Amadon 1968). The American Peregrine Falcon (F. p. anatum) historically inhabitated North America from the treeline in the Arctic to Mexico, and from the Atlantic Ocean to the Coast Mountains. Some American Peregrine Falcons may have lived as far west as the Fraser Valley and the Canadian Gulf Islands (Beebe 1974). The subspecies continues to survive in the British Columbia interior. In 1978 it was designated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

The tundra Peregrine Falcon (F. p. tundrius) breeds in the Canadian Arctic north of the treeline (Godfrey 1986) and was designated as threatened by COSEWIC. The Peale's Peregrine (F. p. pealei) is a subspecies found in scattered concentrations along the west coast from Washington to Alaska. The British Columbia population of this falcon is concentrated in the Queen Charlotte Islands. In lesser numbers, the subspecies occupies northern Vancouver Island and the mainland coast. COSEWIC has designated the bird as rare, a designation given to a subspecies which, for a number of natural or other reasons, is vulnerable, but not threatened.

The name peregrine, from the Latin peregrinus, means "wanderer" or "traveller," and is an apt choice for the bird. Peregrines can be found on all continents except Antarctica (Brown and Amadon 1968). Those nesting in the northern regions, especially the tundra and American Peregrine subspecies, migrate to Central and South America to winter. Other Peregrine Falcons migrate little, if at all.

Being at the top of the food chain, the Peregrine Falcon is never likely to thrive in great numbers. Nonetheless, healthy populations survive throughout much of its historical range. Britain has more than 800 breeding pairs; Ireland, 300 pairs (Ratcliffe, in press). Other population estimates are: Italy, 500 pairs (Allavena, in press); France, 600 pairs (Monneret, in press); Australia, 4,500 pairs (Olsen and Olsen, in press); and West Germany, 130 pairs (Mebs, in press). An estimated 450 to 500 pairs of Peale's Peregrines inhabit Alaska (Ambrose et al., in press), and some 100 pairs live on the British Columbia coast, according to British Columbia Wildlife Branch surveys.

Drastic declines in the European and North American Peregrine Falcon population in the late 1950s and early 1960s have been attributed to DDT and other persistent organochlorine compounds (Hickey 1969; Ratcliffe 1970, 1980), despite some arguments to the contrary (Beebe 1974, n.d.). The Canadian population of American Peregrines, especially those east of the Rocky Mountains, suffered severely, as did some populations of tundra Peregrine Falcons in the Yukon and Ungava (Cade and Fyfe 1970; Fyfe et al. 1976; D. Mossop, pers. comm.). Peale's Peregrines on Langara Island also suffered losses (Cade and Fyfe 1970), though the decline was attributed to shortages of food (Nelson and Myers 1976), not contamination.

Several Langara Island studies (Beebe 1960; Nelson 1976, pers. comm.), falconers' records and British Columbia Wildlife Branch surveys (Blood 1968, 1969; Smith et al. 1976; Munro and van Drimmelen, in press; British Columbia Wildlife Branch, unpubl. data) yield estimates of the number of breeding Peale's Peregrine Falcons in British Columbia. Munro and van Drimmelen (in press) recently reviewed all available data on nesting Peregrine Falcons on the Queen Charlotte Islands, excluding Langara Island.

Taking into account Langara Island population estimates from other sources, the Queen Charlotte Islands population decreased from a maximum of 108 pairs in the 1950s to a 1975 low of 56 pairs. The birds recovered to at least 76 pairs in 1980, but a 1986 British Columbia Wildlife Branch study indicates the population has again decreased to 1975 levels. Table 1 contains estimates and survey results for Langara Island; Tables 2 and 3 depict the population for the whole of the Queen Charlotte Islands.

Surveys of the mainland coast have been confined to work by Royal British Columbia Museum staff (Campbell et al. 1977) and British Columbia Wildlife Branch observations made in conjunction with falconers in 1984 and 1985. In the surveyed areas, six breeding pairs were observed, indicating a sparse and localized population.

Wildlife Branch surveys of the Gulf Islands in 1980 and 1986 revealed five pairs and four pairs respectively, a small but stable population. It is not certain whether the Gulf Island falcons are Peale's, American, hybrids of the two, or some of each.

A 1986 helicopter survey and a 1987 boat survey provided population estimates for parts of northern Vancouver Island and Triangle Island. The 1986 survey detected six occupied sites, and nine were found in 1987. Although the surveys involved different areas, there was some overlap, resulting in a total count of 14 occupied sites, which suggests a moderate Peregrine Falcon population.

TABLE 1. Number of breeding pairs of Peregrine Falcons on Langara Island 1950's-1987.

Year	Number of Pairs	Source
1950's	21-23	Beebe 1960; Nelson & Myres 1976
65-67	7-10	Blood 1968
1968	6	
1969	6	
1970	5	
1971	6	
1972	5	
1973	6	
1974	6	
1975	6	
1976	6	
1977	5	Nelson 1977, pers. comm.
1978	5	
1979	6	
1980	6	
1981	6	
1982	6	
1983	7	
1984	7	
1985	5	
1986	5	
1987	5	

TABLE 2. Minimum breeding population (pairs) estimates for Peregrine Falcons on the Queen Charlotte Islands - 1950's to 1986.

Time Period	Source	Estimated Total Pairs
1950's	Beebe 1960; Nelson and Myres 1976; Munro and van Drimmelen, in press.	106-108
1965-67	Blood 1969.	43-60
1970-74	Munro and van Drimmelen in press; Table 1.	67
1975	Smith et al. 1976; Munro and van Drimmelen, in press.	56
1980	Munro and van Drimmelen, in press.	76
1986	1986 Wildlife Branch Survey data.	57*

* Helicopter survey located 39; comparison with boat surveys showed helicopter located 68% of those pairs found by boat, thus helicopter observations were multiplied by 1.47 to provide estimate, see text.

TABLE 3. Minimum breeding population (pairs) estimates for Peregrine Falcons on the Queen Charlotte Islands by general location. Sources as in Table 2.

Area	TIME PERIOD			
	1965-67	1975	1980	1986
East Moresby Island	19-28	14	21	18
West Moresby Island	4-7	17	25	16
West Graham Island	13-15	20	24	19
Langara Island*	7-10	5	6	4
TOTAL	43-60	56	76	57

* A comparison with Table 1 indicates Branch surveys underestimated by one pair the numbers on Langara Island in both 1975 and 1986.

Before 1986 British Columbia Wildlife Surveys were done by two people in a small boat using gunfire to frighten the birds into flight:

> "The inventory technique consisted of firing a shot from a boat in the vicinity of all cliffs. Although a normal shotgun shell was usually utilized, where it was impossible to approach sufficiently close to a cliff for a shotgun blast to be heard above the roar of the surf, use was made of either a tele-shot (a firecracker-type shell) or rifle shells...a nesting attempt was considered to have occurred if a site was occupied by two birds." (Smith et al. 1976)

If one bird was seen, the site was considered occupied only if the bird exhibited strong defensive behaviour. There was concern that some pairs may have been missed because mainland Peregrine Falcons sometimes nest in trees (Campbell et al. 1977). However, tree-nesting Peregrine Falcons have never been reported on the Queen Charlotte Islands. The preferred nesting site appears to be cliffs near colonies of small seabirds on which the Peregrine Falcons prey. These sites are readily available. However, some Peregrine Falcons may have been missed, and these estimates should be considered conservative.

The 1986 survey was conducted from a helicopter, according to a method developed by White and Sherrod (1973) and modified by the Wildlife Branch for use on the Queen Charlotte Islands. A control was obtained by surveying 30 percent of the total survey area by both boat and helicopter. In the control, the helicopter survey detected 15 nesting sites, or 68 percent of the 22 sites located by boat. Therefore, the total helicopter count of 39 defended sites was multiplied by 1.47 to yield the estimate given in Table 2.

BIOLOGY

Studies of Peregrine Falcons performed by Nelson (1970, 1977) on Langara Island provide excellent information on the bird's breeding habits. Courtship displays begin in early March and usually result in previously paired birds reuniting and defending the same territory as in earlier years, unless one of the adults has died. For the two weeks before the eggs are laid, the male does most hunting. The eggs are laid in early April, usually one every second day to a total of three or four. Incubation, done mostly by the female, begins around mid-April and lasts 31 to 33 days. During this time, the male is the sole provider.

The eggs hatch in mid-May, and the female does all the brooding, which is continuous for the first 7 to 10 days, then becomes sporadic depending on weather and the number of nestlings. While the male hunts and delivers food, for the first few days all actual feeding is done by the female. As the chicks mature, both adults are able to leave the nest to hunt.

First flight for the young comes at 41 to 44 days of age. Within a few days, food is transferred in flight, from the adult's foot to that of the young falcon. Despite this aerobatic capability, the young will not be independent for another six weeks. Banding information has revealed that some young British Columbia Peregrine Falcons winter in California, while others remain in British Columbia. The Queen Charlotte Island adult population is resident year round.

Annual productivity rates on Langara Island have ranged from 1.67 to 3.33 young per successful pair (Nelson 1977, pers. comm.), a rate more than adequate to maintain a stable population (Nelson 1976). No reliable productivity statistics are available for elsewhere in the Queen Charlotte Islands.

The main food for Queen Charlotte Islands Peregrine Falcons is the ancient murrelet, a small colonial seabird that nests in burrows under mature forests. (Beebe, 1960; Nelson 1970; Vermeer et al. 1984). Fluctuations in the ancient murrelet population have resulted in corresponding fluctuations in the peregrine population (Nelson and Myres 1976).

POPULATION DYNAMICS

To maintain a stable population, enough young birds must survive into adulthood to compensate for mortality among adults. In simple terms, each pair of falcons need produce only two young during their lifetime that reach breeding age to maintain existing populations. Additional surviving young will increase the total population. Any surviving "surplus" birds will become part of a floating, non-breeding population. This happens when the falcon population is at a level known as "saturation." Saturation occurs when all nesting territories are occupied by pairs of breeding adults. There is considerable reason to believe the Peregrine Falcon population on the Queen Charlotte Islands is saturated.

The brown plumage of immature Peregrine Falcons makes them easily distinguishable from adult birds. If adult falcons are in short supply, one year old birds will mate, though the mating will usually not produce young (Nelson 1977; Ratcliffe 1980). Therefore, in a population that is not saturated (in which all available breeding territories are not occupied), some one year old Peregrine Falcons would be paired. This is not the case; for many years there have been no brown birds among the pairs on Langara Island (Nelson, pers. comm.). Nor did the 1986 British Columbia Wildlife Branch survey reveal any brown birds defending territories.

Another indication of saturation is the territorial battles which occurred on Langara Island when the breeding Peregrine Falcon population was in decline due to reduced food supplies (Nelson and Myres 1976; Nelson 1977). If there was not a large floating, non-breeding adult population, a paired adult that died would not immediately be replaced. With one exception, all 39 breeding Peregrine Falcons known to have disappeared since 1969 have been replaced by an adult bird (Nelson, pers. comm.). Further, the number of breeding pairs has remained quite constant.

The floating population is estimated to be at least one-half as large as the breeding population (Nelson 1977, 1983). Nelson's observations have been reinforced by population increases witnessed in Alaska and Scotland, where in six years Peregrine Falcons almost doubled in number, suggesting the presence of a large floating population that will breed if conditions are favourable (Ambrose et al., in press; Ratcliffe, in press). The 1986 helicopter survey found 39 defended sites and 10 single adults not defending a nesting site, a considerable number given the difficulty of spotting a floating peregrine.

There is insufficient information on historical seabird populations on the Queen Charlotte Islands to determine the existence or impact of food shortages as a limiting factor in the Peregrine Falcon population. However, seabird populations on Langara Island have been recorded. Early accounts (Beebe 1960; Drent and Guiguet 1961) suggest a major decline to 80,000 or 90,000 breeding pairs occurred by 1971, and by 1981 the number had shrunk to 22,500 pairs (Vermeer et al. 1984). The degree to which Peregrine Falcons depend on the studied seabirds, as opposed to other seabird concentrations which feed offshore, is not known.

Fluctuations in the Peregrine Falcon population during the last 10 years cannot be attributed to any one cause. Natural fluctuations, food shortages, or even phenomenon such as El Nino, could be responsible. However, the above information suggests that the Queen Charlotte Islands Peregrine Falcon population is self-regulating and near or at the saturation level as determined by food supply. It can also be expected that the falcon population will vary with fluctuations in the food supply. Management of the Peregrine Falcon population therefore begins with the management of the food supply (see Munro and Campbell 1979; Vermeer et al. 1984; Kaiser and Lemon 1987).

REGULATIONS AND USE

All raptorial birds in Canada are controlled under law by the province in which they occur. Falcons and other birds of prey were not protected in B.C. until 1961, following intensive lobbying by falconers (Munro 1979, 1982). The birds have since been protected by the Wildlife Act and regulations. It is illegal to take, molest or destroy a falcon, its nest or eggs, or to hold a live bird in captivity without a permit. Permits are issued only for scientific use or falconry.

Numerous permits were issued in the 1960s, allowing the removal of falcons from the Queen Charlotte Islands. In some years, 40 birds were taken from the wild (Blood 1968), and a growing concern led to inventories and restrictions on the number of permits issued. The last major harvest was conducted in 1972, when 10 permit holders took nine birds (B.C. Wildlife Branch files). In 1979, two Peregrine Falcons were taken under special ministerial authority. Two others were taken from the mainland coast in 1984 in conjunction with a Wildlife Branch survey and falconer harvest (B.C. Wildlife Branch files). There was some evidence of limited poaching, especially in the early 1970s.

The export of wild Peregrine Falcons from British Columbia is prohibited. Persons holding breeding agreements issued by the Wildlife Branch can export birds which were bred in their facilities. All breeding facilities are inspected and approved, and captive-bred birds must have seamless leg bands attached by a Ministry of Environment and Parks officer before the chicks are two weeks old. Cade (1986) provides a review of captive breeding.

The major markets for Peregrine Falcons are in the United States and western Europe, where captive-bred birds from British Columbia sell for $2,000 each (B.C. Wildlife Branch files). Peale's Peregrine Falcons are in demand for breeding and falconry, a sport practiced by about 150 people in British Columbia. Because of the expense and difficulty of obtaining Peregrine Falcons, few falconry practitioners use the species. Permits to hold a Peregrine Falcon are granted only after the applicant has held another raptor for at least two years, and thus has gained experience in caring for the birds. An inspection of the facilities by Ministry of Environment and Parks staff is also necessary.

Peregrine Falcons have been successfully bred by four persons holding breeding agreements in British Columbia. Captive-bred birds are being used in Canada and internationally for falconry and breeding, and have been used to re-introduce Peregrine Falcons into the wild in the U.S. Most Peregrine Falcons in captivity in British Columbia are of mixed subspecies, and descendents of a restricted number of birds taken from the wild years ago. There are few pure Peale's Peregrine Falcons remaining in captivity.

OPTIONS AND IMPLICATIONS OF USE

Merit can be found in arguments both in favour of leaving the Queen Charlotte Island Peregrine Falcons in the wild and in favour of capturing some birds for falconry and captive breeding.

Wild Peregrine Falcons are the object of much attention and appreciation. Often, day trips are planned around the possibility of sighting a wild falcon. Fishermen keep a sharp vigil to help prevent poaching. While it is impossible to measure the extent of this aesthetic appreciation for wild Peregrine Falcons, the continued existence of a viable, healthy, wild population is the first priority.

Removing no Peregrine Falcons from the wild, though it may best represent public sentiment, has implications reaching beyond the desires of falconry and breeding interests. The population would continue unaffected, and fluctuate with natural influences. However, were a major catastrophe to occur, such as an oil spill or excessive predation of the seabirds on which Peregrine Falcons depend for food, captive-bred birds could be used to re-introduce or augment the wild population.

If some young Peregrine Falcons are to be captured, the first concern is the impact their removal would have on the wild population. The actual capture involves climbing to the nest site to obtain the young birds. Properly done, this poses a relatively minor disturbance (Brucher, in press; Craig et al., in press; Endersen et al., in press; Fyfe and Olendorff 1976; Nelson 1977).

Evidence presented earlier suggests that a large floating, non-breeding population inhabits the Queen Charlotte Islands. Provided that the floating population is not depleted, and falcons from it are able to take the place of any breeding birds that die, the breeding population should remain constant.

Banding returns from studies done elsewhere indicate that the mortality rate of Peregrine Falcons in their first year is 50 percent and higher and the mortality of two year olds is about 20 percent (Nelson, pers. comm.; Ratcliffe 1980). In 1987, the five pairs nesting on Langara Island produced 13 young, or 2.6 young per pair. At that rate of reproduction, the estimated 57 breeding pairs in the Queen Charlotte Islands would produce 148 (2.6 x 57) young. Average mortality rates would reduce that generation to 74 (148 minus 50 percent) the first year, and to 59 (74 minus 20 percent) falcons the following year, by the age at which they would enter the adult floating population. Were 10 young removed from the nest, the number of young birds left in the wild would total 138 (148 minus 10). Using the same mortality rates in each of the first two years, 55 of the 138 wild falcons would survive to join the adult floating population. The harvest of 10 nestlings would have a net effect of reducing the floating population by four adult Peregrine Falcons (59 minus 55).

Removing young birds would also have the effect of reducing mortality of the parent falcons. Raising large broods taxes the parent birds to an extent which reduces their chances of surviving the following winter (Nelson, in press). Adults feeding four young undergo greater stress than adults feeding two young. A condition of capture would stipulate that two young falcons be left in each nest. Therefore, only nests with three or more young could be affected, and a Ministry of Environment and Parks officer would be present to assure this condition is obeyed.

Any falcons removed from the wild would become the property of the British Columbia government, and would be prohibited from leaving the province. Normally, the young Peregrine Falcons would be raised by falconers and trained to hunt. They would likely be flown regularly for the first two years, and upon reaching breeding age, would be bred in private breeding facilities. The offspring would be the property of the breeder and all or a portion could be exported according to the discretion of the government.

Young falcons taken into captivity have a high first year survival rate, as do the captive birds' progeny. On average, a captive Peregrine Falcon reproduces from the time it is three to five years old, until it is 15 to 17 years of age. Some captive birds live beyond 20 years. Few wild Peregrine Falcons reproduce for more than six or eight years (Nelson, pers. comm.).

Captive breeding has the potential to supply all Peales's Peregrine Falcons required by falconers. In the long term, captive breeding will remove the need for further capture of wild Peregrine Falcons, except to maintain genetic diversity.

Regardless which option is ultimately chosen, the single most critical point in preserving the wild population is to maintain the seabird colonies on which Peregrine Falcons depend for food. If the seabirds disappear, so too will the Peregrine Falcon.

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